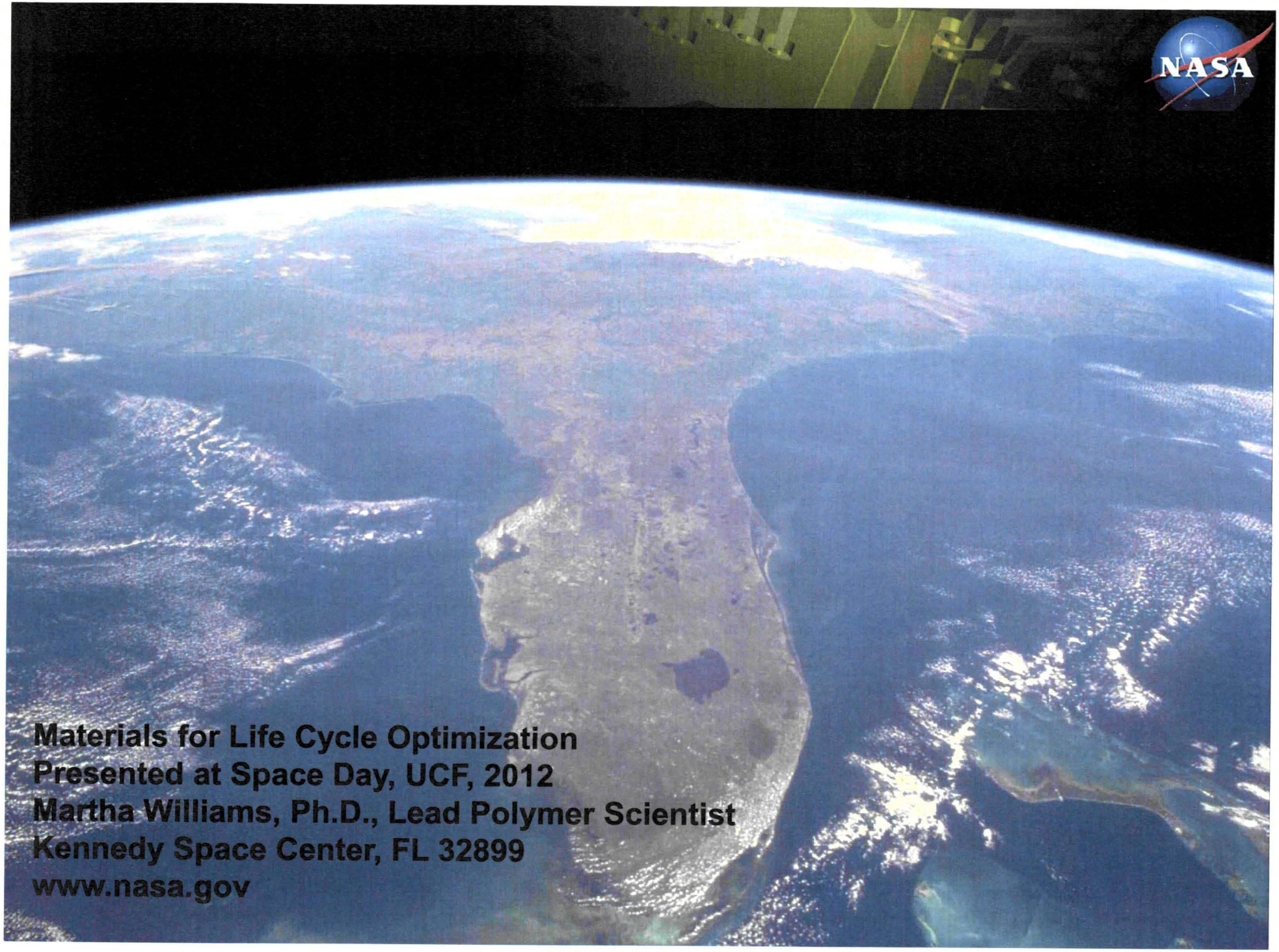
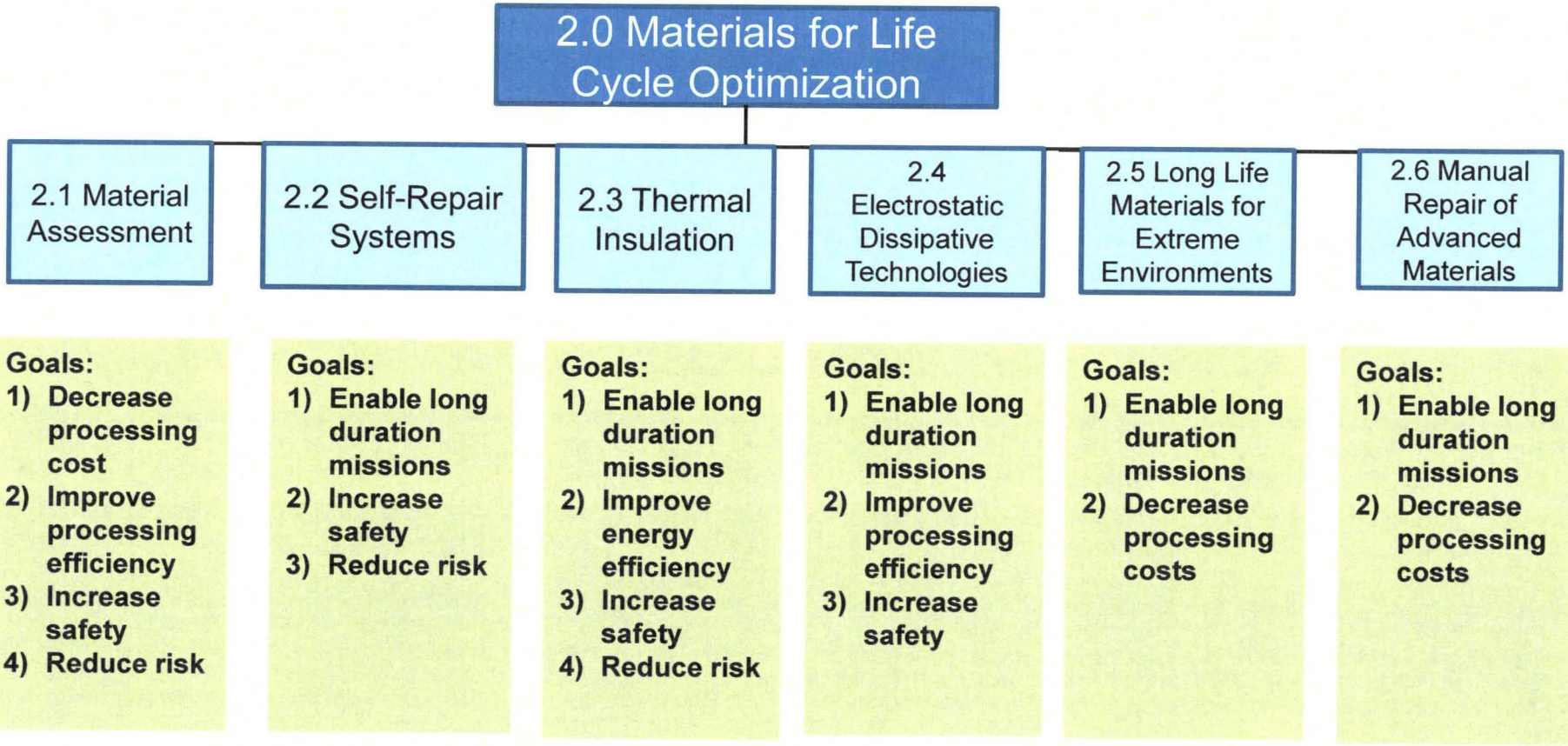


Materials for Life Cycle Optimization

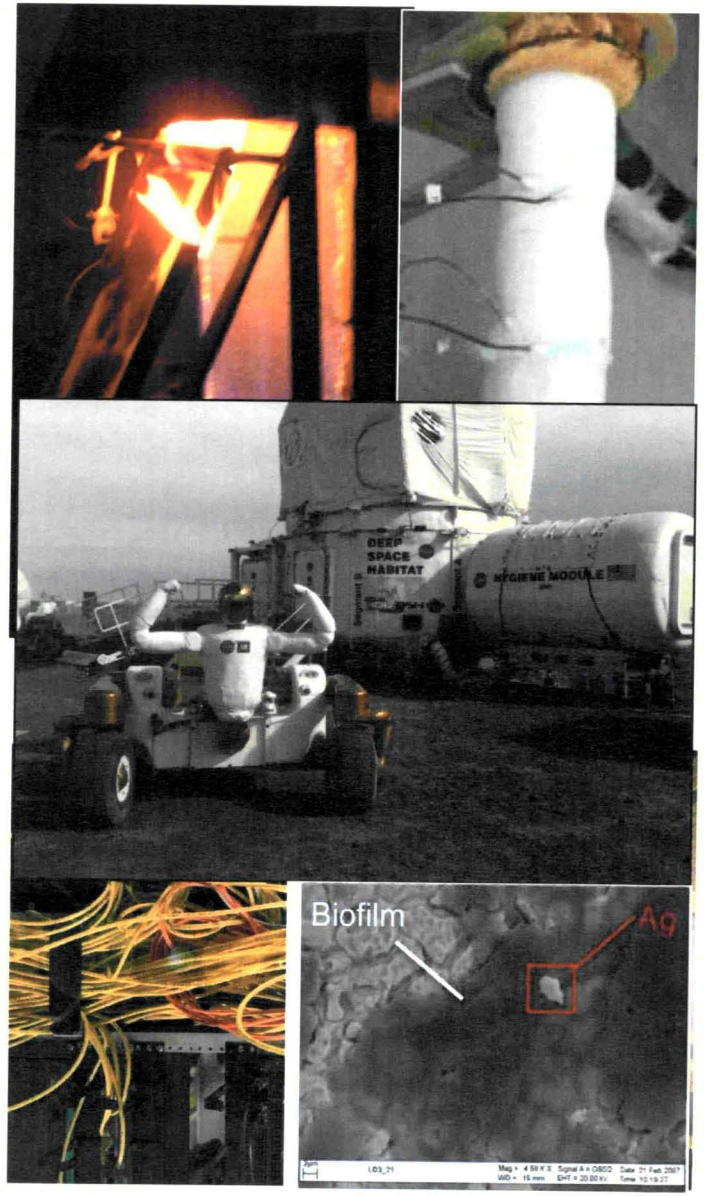


Past and Current Partnerships

- **NASA Centers:** (JSC, LaRC, MSFC, GSFC, and GRC)
- **Academia:** (UCF, UF, USF, FIT, Embry Riddle, Georgia Tech, Alberta, Harding, Illinois-Urbana Champagne, University of Southern Mississippi, Manhattan College)
- **Industry:** (Thermax, DeWAL, Sharklet, Crosslink, Sabic, Amalgam, ARCnano, Epner, Conductive Composites, TE Connectivity, Automobile, Coatings and Pigments Industries)
- **Other Government Agencies:** DoD, including NAVAIR, Air Force and Army; DoE and EPA.

Polymer Science and Technology

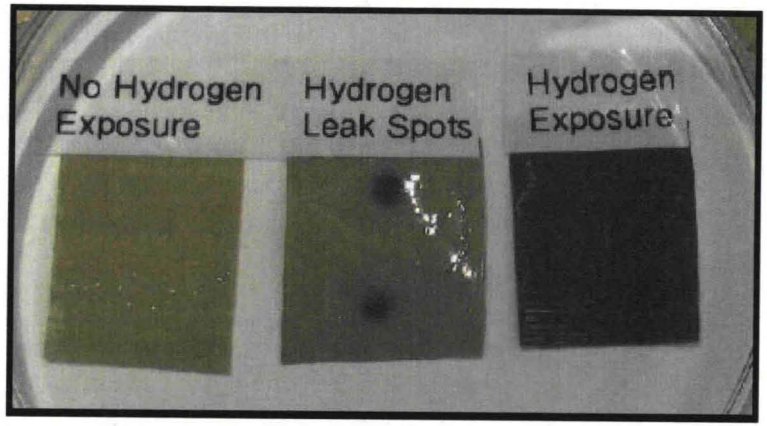
- Flame retardant materials (with FIT)
- Self healing materials for wiring and inflatable structures
- Next generation wire materials, new wire constructions
- Detection systems for wiring and flat surfaces
- Aerogel composites for reducing heat transfer
- Foam thermal insulation materials
- Switchable materials for transient thermal management applications (with UCF)
- Conductive polymers and carbon nantotube (CNT) composites for printed circuitry and damage detection
- Aerogels for environmental remediation
- Chemochromic hazardous gas detectors (with UCF)
- Antimicrobial polymers for potable water system and closed loop systems
- Novel concepts for radiation shielding



Contact: Martha K. Williams, Ph.D.
Martha.K.Williams@nasa.gov

H2 Sensing Technologies and UCF Partnership

KSC Irreversible Sensor

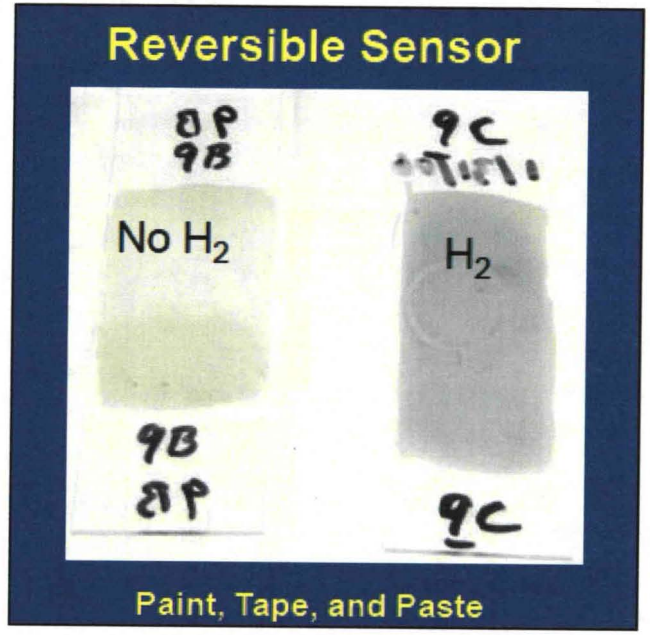


Works like a dosimeter:
Rate of color change depends on concentration and time.

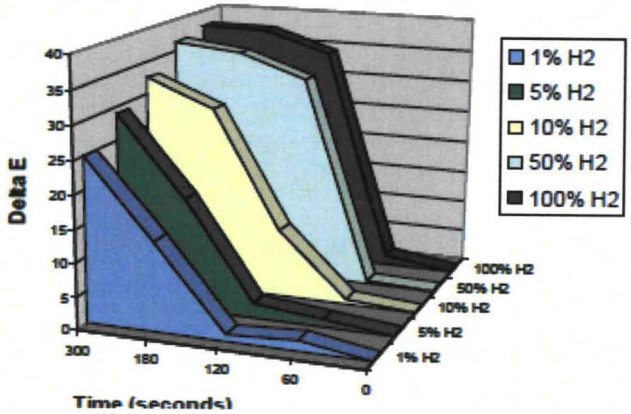
LPA OMBUU Deployment for STS 117, 118, 120, 122, 123

Response time is slower at cryogenic temperatures but sensor can be engineered to avoid these conditions.
and STS 130, 131

UCF



H2 Concentration Effect on Delta E

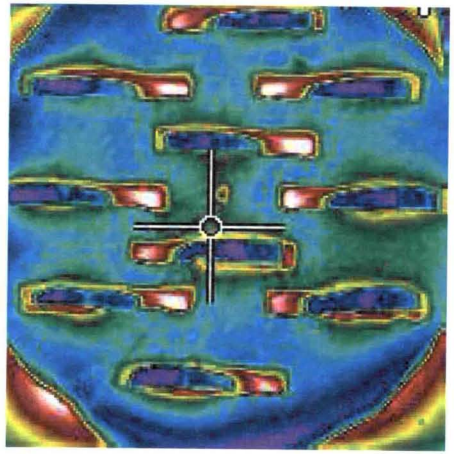


Contact: Luke Roberson, Ph.D.
Luke.B.Roberson@nasa.gov

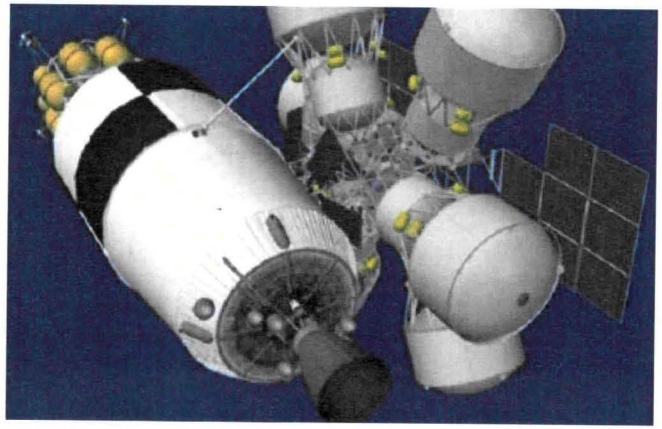
Shape Memory Alloys for Transient Thermal Applications

KSC and Florida Space Institute/University of Central Florida Partnership

- The goal of this project is to bring together novel, unique materials and transient thermal systems. The project will identify novel materials and utilize specialty or custom made shape memory alloys that can adapt under transient thermal management applications, including cryogenic applications. *All within a single architecture*



Infrared image at actuation

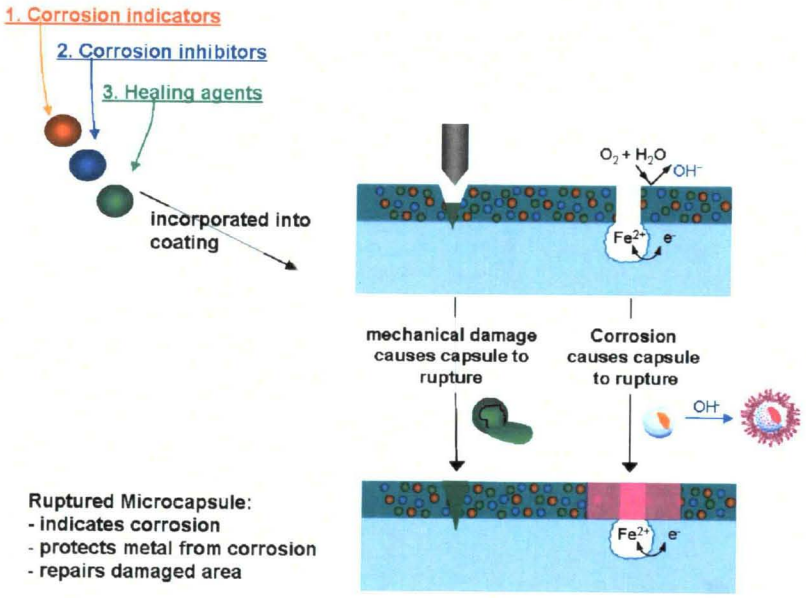


Future applications

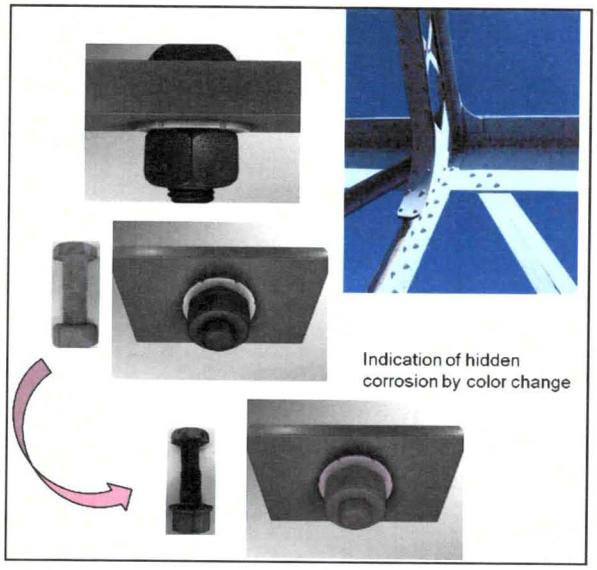
NASA's Corrosion Technology Laboratory

Research and Development

- Coating development (Smart coatings for corrosion detection and control).
- Corrosion resistant materials and maintenance procedures for different environments.
- Investigation of materials degradation in different environments.
- Long-term prediction of corrosion performance from accelerated tests.
- Detection of hidden corrosion.
- Self-healing coatings.



Smart-Multifunctional Coating Concept



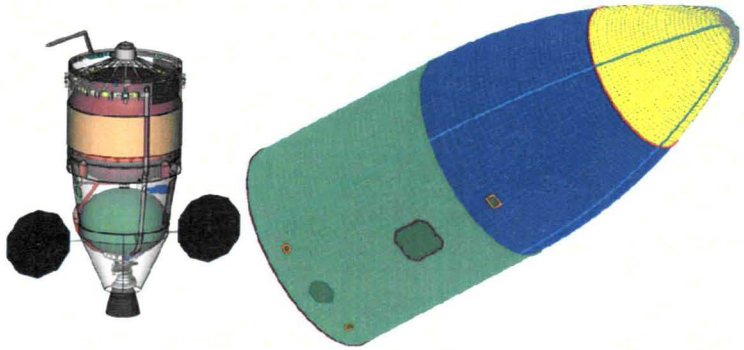
Hidden Corrosion Indication Concept

Contact: Luz Marina Calle, Ph.D.
Luz.M.Calle@nasa.gov

Fiber Composites Research and Development

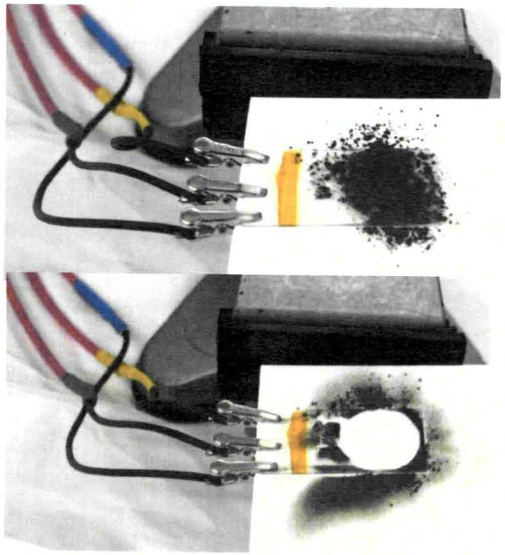
- NASA Exploration Systems Directorate Composites for Exploration (CoEx)
  - Inter-center team responsible for investigating the potential to develop composite materials and structures technologies
  - Largest composite aerospace structures ever made - heavy lift launch vehicle payload fairing applications.
- NASA Office of Chief Technologist/Game Changing Division Composite Cryotank Technologies and Demonstration Project (CCTD)
  - Inter-center team responsible for developing and demonstrating advanced composite technologies
  - Goal is to achieve 30% weight savings 25% cost savings of LH_2 composite cryotanks.
- Non-destructive evaluation, inspection tools and structural health monitoring
  - Developing new tools that will allow for inspection and continual monitoring of fiber reinforced composite systems
- Self-repair for fiber composite systems

Contact: LaNetra Tate, Ph.D.
LaNetra.C.Tate@nasa.gov
321-867-3789

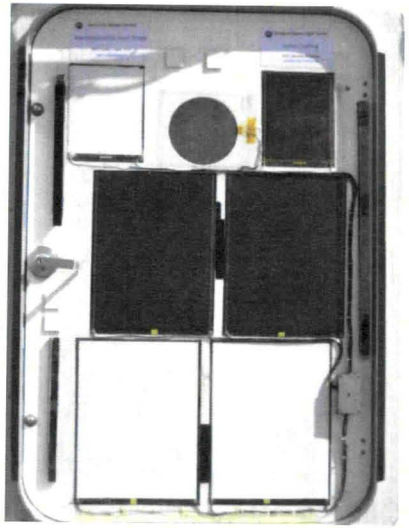


Electrostatics & Surface Physics Laboratory

- Dust mitigation and electrostatic dissipative technologies for Lunar and Mars Exploration
- Habitat Demonstration Unit dust mitigation panels
- Dust mitigation technologies for Materials International Space Station Experiment (MISSE)
- Electrostatic dissipative technologies for optical systems
- NIAC Research regolith-derived heat shields for atmospheric entry
- Electrostatic dust precipitation for *In-situ* Resource Utilization (ISRU)



Right – EDS on HDU hatch before operation
Left – EDS after operation



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Dr. Michael Hogue
Michael.D.Hogue@nasa.gov

Specialty Capabilities at KSC

Capabilities:

- **KSC Beachside Atmospheric Exposure Contact Information**
  http://corrosion.ksc.nasa.gov/
  Dr. Luz Marina Calle.
  Luz.M.Calle@nasa.gov
- **Unique Electrostatics and Surface Physics Laboratory**
  Dr. Carlos I. Calle
  Carlos.I.Calle@nasa.gov
- **One-of-a-kind Cone Calorimeter for fire testing**
  Dr. Martha. K. Williams
  Martha.K.Williams@nasa.gov
- **Composite repair new procedures and techniques for out of autoclave**
  Dr. Lanetra C. Tate
  Lanetra.C.Tate@nasa.gov